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# National Advisory Committee for Aeronautics

# Research Abstracts

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## CURRENT NACA REPORTS

NACA TN 2530

WIND-TUNNEL INVESTIGATION OF SIX SHIELDED TOTAL-PRESSURE TUBES AT HIGH ANGLES OF ATTACK. SUBSONIC SPEEDS. Walter R. Russell, William Gracey, William Letko and Paul G. Fournier. November 1951. 25p. diagrs., tab. (NACA TN 2530)

Calibrations of six shielded total-pressure tubes over an angle-of-attack range of -30° to 65° at Mach numbers of 0.26, 0.50, 0.70, 0.90, and 0.95 are presented. One of these tubes was a standard Kiel design, while the other tubes were variations of this design. The design variables which were investigated included the shape of the venturi entry (conical and curved), the position of the total-pressure probe with respect to the leading edge of the shield, the internal diameter of the shield, and the shape of the leading-edge profile. The effect of these variables on the range of angle of attack over which the tubes remained insensitive to inclination is discussed.

NACA TN 2533

EVALUATION OF HIGH-ANGLE-OF-ATTACK AERODYNAMIC-DERIVATIVE DATA AND STALL-FLUTTER PREDICTION TECHNIQUES. Robert L. Halfman, H. C. Johnson and S. M. Haley, Massachusetts Institute of Technology. November 1951. 154p. diagrs., photos., 11 tabs. (NACA TN 2533)

The aerodynamic reactions on wings oscillating harmonically in pitch and translation in the stall range have been measured, evaluated, and correlated where possible with available published data. Data on the time-average values in the stall range of both lift and moment are presented. The results of numerous experimental observations of stall flutter have been reviewed and known attempts at its prediction have been examined, compared, and extended. A semi-empirical method of predicting the variations of moment in pitch with airfoil shape, reduced frequency, initial angle of attack, and amplitude of oscillation has been presented.

NACA TN 2534

EXPERIMENTAL INVESTIGATION OF THE LOW-SPEED STATIC AND YAWING STABILITY CHARACTERISTICS OF A 45° SWEPTBACK HIGH-WING CONFIGURATION WITH VARIOUS TWIN VERTICAL WING FINS. Alex Goodman and Walter D. Wolhart. November 1951. 25p. diagrs., photos., 3 tabs. (NACA TN 2534)

Results are presented of an investigation of the low-speed static and yawing stability characteristics of a 45° sweptback high-wing, low-horizontal-tail configuration with various twin vertical fins located on the wing. The static and yawing stability characteristics obtained with the various twin-fin configurations are compared with the characteristics of a similiar configuration with a single vertical tail at the rear of the fuselage. In addition, the effects of a small vertical fin at the rear of the fuselage on the characteristics of the twin-fin configurations are presented.

NACA TN 2539

APPLICATION OF VARIATIONAL METHODS TO TRANSONIC FLOWS WITH SHOCK WAVES. Chi-Teh Wang and Pei-Chi Chou, New York University. November 1951. 32p. diagrs., 4 tabs. (NACA TN 2539)

By modifying Bateman's variational principle for irrotational flows, it is shown that a variational principle for flows with rotation and variable entropy can be obtained. By applying this variational principle to the regions of flow behind shock waves and Bateman's original principle to the other regions in the fluid, shock equations can be directly obtained. A procedure for computing numerical solutions for such flows is suggested, and a numerical example is carried out. The results show that when the Mach number increases to a certain limiting value without allowing for shock waves the variational method does not have a solution. This probably indicates the breakdown of the irrotational flow. By allowing shock waves to occur, solution again exists.

NACA TN 2540

APPLICATION OF RESPONSE FUNCTION TO CALCULATION OF FLUTTER CHARACTERISTICS OF A WING CARRYING CONCENTRATED MASSES. H. Serbin and E. L. Costilow, Purdue University. November 1951. 52p. diagrs., 3 tabs. (NACA TN 2540)

Concepts involved in the harmonic-response-function method, such as the direct or conjugate characteristic modes, are illustrated by application of the method to the calculation of the change in flutter characteristics of a wing due to adding concentrated masses. The rigid body is first idealized as a point mass, then as a distributed mass. The main purpose of the numerical procedures which are given is to illustrate the scope of the method and to make some of its abstract formulations more specific. An appendix is given which contains some of the essential theoretical background.

*AVAILABLE ON LOAN ONLY.

ADDRESS REQUESTS FOR DOCUMENTS TO NACA, 1724 F ST., NW., WASHINGTON 25, D. C., CITING CODE NUMBER, TITLE AND AUTHOR.

NACA TN 2541

STUDIES OF VON KARMAN'S SIMILARITY THEORY AND ITS EXTENSION TO COMPRESSIBLE FLOWS. A CRITICAL EXAMINATION OF SIMILARITY THEORY FOR INCOMPRESSIBLE FLOWS. C. C. Lin and S. F. Shen, Massachusetts Institute of Technology. November 1951. 24p. (NACA TN 2541)

Von Kármán's similarity theory for incompressible flows is examined critically by using modern concepts in order to provide a basis for extending the theory to compressible flows. It is found that the original form of the theory is supported by modern concepts.

NACA TN 2544

HYDRODYNAMIC LUBRICATION OF CYCLICALLY LOADED BEARINGS. R. W. Dayton and E. M. Simons, Battelle Memorial Institute. November 1951. 76p. diagrs., photos. (NACA TN 2544)

Results are presented of an experimental investigation conducted in order to check the validity of analytical studies of simple cases of cyclic loading and to determine the effect of the loading conditions on hydrodynamic lubrication when the load diagram is so complex that analytical treatment is difficult or impossible. A precise test bearing was set up to which constant or varying unidirectional loads or constant rotating loads could be applied, singly or together, and the effect of the load diagram on hydrodynamic lubrication was measured from the attitude of the journal in the bearing.

NACA TN 2546

VISCOSITIES OF AIR AND NITROGEN AT LOW PRESSURES. Herrick L. Johnston, Robert W. Mattox and Robert W. Powers, Ohio State University. November 1951. 22p. diagrs., 6 tabs. (NACA TN 2546)

Information is presented of the results of an investigation to measure the viscosities of nitrogen and air at 306° and 273° K at pressures from 500 to 0.0005 millimeter of mercury and at 194° and 79° K at pressures down to 0.3 millimeter of mercury.

NACA TN 2555
National Advisory Committee for Aeronautics.
EFFECT OF TAPER RATIO ON THE LOW-SPEED ROLLING STABILITY DERIVATIVES OF SWEPT AND UNSWEPT WINGS OF ASPECT RATIO 2.61. Jack D. Brewer and Lewis R. Fisher. November 1951. 17p. diagrs., photo. (NACA TN 2555. Formerly RM L8H18)

Results of tests conducted in the 6-foot-diameter rolling-flow test section of the Langley stability tunnel to determine the effects of varying taper ratio on the rolling and static stability characteristics of a swept wing are presented; results are also given for the effects of varying taper ratio on an unswept wing and for the effects of sweep on a tapered wing. All the models were of aspect ratio 2.61 and had NACA 0012 sections normal to the quarter-chord line. Taper ratios of 1.00, 0.50, and 0.25 and sweep angles of 0° and 45° were investigated.

NACA TN 2564
National Advisory Committee for Aeronautics.
PROPERTIES OF HONEYCOMB CORES AS AFFECTED BY FIBER TYPE, FIBER ORIENTATION, RESIN TYPE, AND AMOUNT. R. J. Seidl, D. J. Fahey and A. W. Voss, Forest Products Laboratory. November 1951. 36p. diagrs., photos., 6 tabs. (NACA TN 2564)

An investigation was conducted to determine the effect of fiber type, fiber orientation, resin type, and resin content on the strength properties of honeycomb core structures. The structures examined were made from nonwoven cotton, nonwoven rayon, and paper. Some cores had the principal fiber grain parallel to and others had it perpendicular to the cells of the honeycomb. One or more resins in varying amounts were used to impregnate or bond the three materials.

## BRITISH REPORTS

N-11054*

National Gas Turbine Establishment (Gt. Brit.)
A NOTE ON RADIATION HEAT TRANSFER. G. A. E. Godsave. March 1951. 21p. diagrs. (NGTE Memo. M.111)

The majority of previous discussions of radiation heat transfer between surfaces have been restricted to the case where the surfaces are considered to be grey and opaque. In this paper the case of interchange of radiation between surfaces that may partly absorb, reflect and transmit the incident radiation is considered. The surfaces are considered to be selective emitters. Expressions for calculating radiation heat transfer under these conditions are derived in particular for parallel plane surfaces, concentric spherical surfaces and concentric cylindrical surfaces. Both regularly reflecting and diffusely reflecting surfaces are discussed. For the special case of grey opaque surfaces these expressions all reduce to those previously published by other authors for this case.

N-11077*

Ministry of Supply (Gt. Brit.)
FATIGUE TESTS ON SHOT PEENED 64 TON CAST STEEL. 9p. photos., diagrs. (MOS S & TM 7/51; Metropolitan-Vickers Electrical Co., Ltd., Manchester. Research Dept. C.651, December 1947)

Fatigue tests on cast 64-ton steel "T" specimens have shown that shot peening following the normal "scurfing" (shot-blasting) process given to castings carries no additional advantage. Increasing the fillet radius shows a small definite improvement although

the general level of the fatigue i.e. 30-35 percent of the U.T.S. is low.

N-11078*

Ministry of Supply (Gt. Brit.)
FATIGUE TESTS ON SHOT PEENED 74/78-TON, CR-MO CAST STEEL. 8p. diagrs. (MOS S & TM 11/51; Metropolitan-Vickers Electrical Co., Ltd., Manchester. Research Dept. C.688, December 1948)

Fatigue tests on 74/78-ton Cr-Mo "T" shaped steel castings indicates that shot peening machined surfaces improves the fatigue resistance by about 27 percent.

N-11080*

Royal Aircraft Establishment (Gt. Brit.)
APPARATUS FOR THE LABORATORY INVESTIGATION OF THE HIGH ALTITUDE WEAR OF CARBON BRUSHES. R. F. Sims, J. G. Carr and C. Algar. May 1951. 37p. photos., diagrs. (RAE Tech. Note EL.25)

Apparatus for the laboratory investigation of high altitude brush wear and the testing of brushes intended for use at high altitudes is described. Some account of the precautions necessary to ensure reproducible results is given and it is shown that experimental errors are small compared with the variations in performance between nominally similar brushes.

## UNPUBLISHED PAPERS

N-9948*

EXPERIMENTAL INVESTIGATIONS ON AN AXIAL BLOWER STAGE. (Experimentelle Untersuchungen an einer axialen Geblasestufe). Ernst Muhlemann. July 1951. 96p. diagrs., photos., 5 tabs. (Trans. from Eidgenössische Technische Hochschule Zürich. Institut für Aerodynamik. Mitteilungen 12, 1946).

A single stage consisting of a stator and rotor was investigated by means of a two-blower test setup for use in a multistage axial compressor. The various losses, particularly friction losses, were analyzed. A rotating pitot tube for wake measurements was developed.

N-10941*

COMPUTATION OF ONE-DIMENSIONAL GAS FLOWS. (Raschet odnoragmernik gazovik techenii). B. M. Kiselev. 29p. diagrs. (Trans. from Prikladnaia Matematika i Mekhanika, v.11, 1947, p.177-192).

Problems of one-dimensional gas flow are solved by means of three equations: the equation of continuity or conservation of mass, the equation of mechanics, and the equation of energy. In a number of papers, the solution is considerably simplified by the application of the initial or stagnation parameters $p_0$, $\rho_0$, and $T_0$, and the introduction of the nondimensional velocity $\lambda = W/a$. The solution of the problems can be still further simplified if these equations are applied in a somewhat modified form. In the present paper, the transformed equations of gas dynamics are given and the effectiveness of the application of these equations is illustrated with the aid of a number of examples. The computation of an ejector is considered in greater detail.

N-11158*

EFFECT OF VELOCITY ON RESISTANCE OF METALS TO PLASTIC DEFORMATION. (Vlianie Skorosti na Soprotivlenie Metallov Blasticheskomu Deformirovaniu). L. D. Sokolov. 12p. diagrs., tab. (Trans. from Zhurnal Tekhnicheskoi Fiziki, v.16, no.4, 1946, p.437-442).

Static (with velocities of 0.01 and 1 mm/sec) and dynamic (with mean velocity of 2000 mm/sec) compression tests were carried out on lead, copper, and steel (with varying carbon content) cylinders 20 millimeters in height in the cold state and at high temperatures. The true stress curves were constructed. A relation was established between the resistance coefficient, the temperature, and the carbon content of the steel.

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